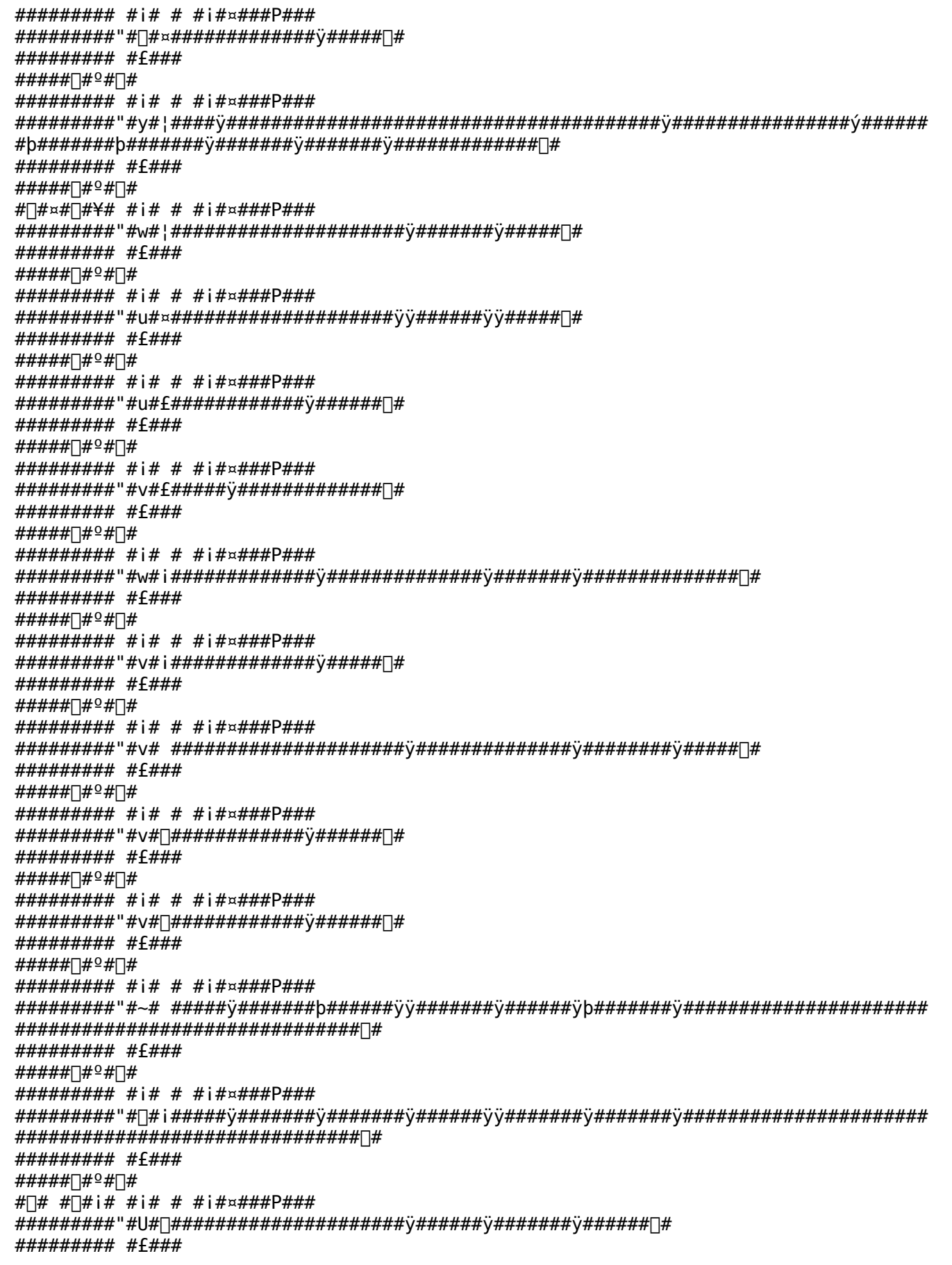

```
###### #□Òø õØú□  Ð############ÿý###«²h #□Àü õ #æ     z############ÿý###«_°
#□Àû#ö9ûè   S############ÿý###«sP###ô####□####ô##L#□###ü=õÚ#É
      @##############u####F#########d###########Development ÐCustomer is Frank
LaMonica from USAF Rome Laboratory Catalyst is a second generation engineering
environmentSPS has ten years of experience building engineering environmentsSPS
learned many lessons from other environment effortsDesigned to address real world
problems faced by environmentsA major problem facing environments is end user
acceptanceDrives many important design considerations in CatalystDesigned to
handle large efforts (tested with 10,000 requirements)Designed by engineers who
spent years on large (50-500 person) efforts Over 25 man-years of development
effort invested in CatalystSPS using Catalyst to help develop CatalystDeveloped
the requirements and test traceability dataUsed to track problem reports and
perform change management##
```

```
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```

Provides one simple and consistent interface to data stored in different tools and databasesUses a simple yet powerful data modelObjects with attributes and relationships with semantics Relationships are typed, bidirectional, and support semanticsCatalyst IDL is relatively short and simple Makes Catalyst easy to understand and integrate with Most tools in use today donÕt support high end featuresStores relationships between data stored in different toolsAllows data to be shared between different toolsAccesses data in place if possible - not a repositoryEliminates the need to load data, avoids redundancyImproves scaling because data remains distributedHelps gain acceptance from users #

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###########ÿý###«z###þ#########þ##L####û¼õú#Û
Rÿÿ####ÿÿ####Uÿu#ÿÿ#F#########d###########=Design ÐIntegrates COTS, GOTS, & Legacy engineering toolsUses integration to provide capabilities not available through COTSDesigned to help get the most out of the available engineering informationDesigned to operate without disrupting on-going engineering efforts Building block approach allows incremental adoption with incremental benefitsData remains in the tool which created it, reducing effort and disruptionBased on the Common Object Request Broker Architecture (CORBA)High performance distributed system avoids bottlenecks and scaling problemsContains operations for managing well specified networks of objects and relationships known as Òobject communitiesÓ Quickly create far too many objects to specify a set of them manuallyObject communities are used for backup, restore, lock, unlock, delete, copy, etc.##

###############   # #########################ÿ¥#ÿÿ#d#########d########L#□###ûBöÍ#" rÿÿ# ##ÿÿ#####ÿ¥#ÿÿ#d#########d###########·Benefits ÐPoint-and-click access to data from all integrated toolsDoes not require any tool expertise (ORACLE, RDD-100, etc.)Link and annotate data stored in different toolsCapture rationale, traceability, and domain informationImpact analysis of data within and across integrated tools Automates the processes your organization usesCapture knowledge about how to perform activitiesAssist new users in following processes correctly Track work product assignments and states Import and export data to and from word processors, spreadsheets, project management tools, graphing programs, etc.Migrate data from tool-to-tool and site-to-siteShare a baseline of data between different sites##

```
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##ÿÿ#####ÿ¥#ÿÿ#d#########d###########ýExisting Tools ÐGraphical Browser (Point-
and-click data viewer/editor)Process Definition and Enactment Tools (Capture and
use processes)Impact Analysis Tool (Collect and organize impacts/solutions)
Administration Tool (Graphical tool for administering projects)Support Tool (Set
up and self test Catalyst)QFD Tool (Prioritize requirements and features)Complete
Tcl Scripting Environment (Analyze and operate on data)Future Tools ÐWinWin,
Media-Doc, Sybil, EMMAWWW Based ToolsLots of other EDCS toolsF#
```

õôýÊþÍÿÿ# ##ÿÿ#####ÿ¥#ÿÿ#d#########d###########YFacilitates discovery and documentation of how changes affect other parts of the system ##

#####□Automates processes used by your organizationHelps users to learn and follow processes Manages flow of work products between different people and processes##

##L#□###û[öQ#¡þ#ÿÿ# ##ÿÿ####ÿ¥#ÿÿ#d########d#########îWrite scripts to read and write data files in the format used by the integrated tool Mapping files allow data to be exported, modified in the integrated tool and imported back into CatalystDoes not require compiling and linking with NEO#

```
###############   #
#########################ÿ¥#ÿÿ#d#########d########L#□###û[öQ#¡þ#ÿÿ####ÿÿ####Uÿu#ÿÿ
#F#########d#Z#########"Write a custom program to read and write data files in the
format used by the integrated tool Used to handle binary or complex data file
formatsMapping files allow data to be exported, modified in the integrated tool
and imported back into CatalystRequires compiling and linking with NEO#
```

```
###############   # ########################ÿ¥#ÿÿ#d#########d########L#□###û#÷(#P
      Sÿÿ####ÿÿ####Uÿ-#ÿÿ#F#########d###########|Created a tight integration of
ORACLEORACLE is very complex and hard to installTook us three weeks on and off to
get ORACLE workingORACLE requires expertise to administerExperience programming
the COTS tool is importantTight integration took four weeks of programmingCreated
a Òread-onlyÓ integrationProbably donÕt want to be changing the RADB at NGWrite
capability could be added in another four weeks if neededObjects could be
created/deleted/modifiedLots of time could be spent making it better and faster
Required moderate amount of CORBA and Catalyst expertiseBasic approach will carry
over to other relational databases#
```

```
###############   # #########################ÿ¥#ÿÿ#d#########d########L#□###ûÝö□#□
      #ÿÿ####ÿÿ####Uÿu#ÿÿ#F#########d############Lightweight Catalyst shadow
object stores a tool ÒkeyÓFrom the Catalyst side the shadow object looks like any
other objectObject responds to the Catalyst Core IDL like usualAttributes can be
read which are actually stored in ORACLEAttributes could also be set which would
change ORACLE tables (if we had implemented this capability)Relationships can be
created between the object and any other object in Catalyst Relational database
tables usually have a unique key to useIt took about three days to get objects
working#
```

```
###############   #
#########################ÿ¥#ÿÿ#d#########d########L#□###ûm÷r#S#□ÿÿ#
##ÿÿ#####ÿ¥#ÿÿ#d#########d###########ýLightweight Catalyst shadow object stores a
tool ÒkeyÓPublishing is creating a shadow object with a ÒkeyÓHow and when to
publish data is an interesting questionOne way is to use the Browser to create an
object and manually set the keyA custom publishing program can be written to read
the tool data and create shadow objectsAn Tcl script can be written to perform the
same functionWe used autopublishing via relationshipsRelated objects are published
as they are found if they are not already published
#
```

###############   #
#########################ÿ¥#ÿÿ#d#########d########L#□###úç÷]#Í#□ÿÿ####ÿÿ####Uÿu#ÿÿ
#F#########d###########nWorks great when there are a small number of ÒrootÓ objects which are related to everything else Would not work well if the data was not strongly connectedApproach to use depends on the tool and the data We added a ÒfindÓ operation to the Core IDL which could be used to autopublish objects which match a search criteriaObject-oriented approaches tend to be very navigation orientedEngineering data seems to have lots of interconnectionsTools or data sets which are very flat could use hierarchies of Catalyst objects to organize the data Would make browsing and working with the data faster and easier to understand#

```
###############   #
########################ÿ¥#ÿÿ#d#########d########L####ú¡öÛ#×#Ïÿÿ####ÿÿ####Uÿ-
#ÿÿ#F#########d###########¦General Relation Manager acts as a transparent
Òclearing houseÓ for relationships Client requests relationships from GRMGRM asks
integrated tool via the shadow objectGRM adds the relationships which it is
storingCombined list is returned to the clientRequires mapping from tool keys back
to Catalyst objectsTool ÒrelationshipsÓ are stored in terms of the toolÕs keys
General problem to be solved by tight integrationsMapping could be stored in a
special ORACLE tableWanted the integration to be completely unintrusiveDecided to
add tool key map capability to GRMMakes the functionality available to future
integrationsGRM already stores most of the information needed#
```

```
###############   # ########################ÿ¥#ÿÿ#d#########d########L#□###ûÝö□##
      &ÿÿ####ÿÿ####Uÿu#ÿÿ#F#########d###########5Took three weeks and a few days
to integrate relationshipsDesign can be reused on future integrations saving time
Some of that time was adding tool key map to GRMTool key map in GRM can be reused
saving timeAutopublishing took some of the timeNeed to be careful to avoid
deadlocks between GRM and servers##
```

```
#############i#d##dPro#######$#############i#□##ÿõ##ÿú#####
#####K#z##|##(#####We need to assess the cost #i#d##dPro#######$##############|##*
#and schedule impacts of:##i#d##dPro#######$##############|##*
#    deleting B-Req 4.4.1##i#d##dPro#######$##############|##*
#    deleting B-Req 4.4.2##i#d##dPro#######$##############|##*
#    changing B-Req 4.4.10#i#d##dPro#######$##############|##*
#    adding B-Req 4.4.10.1#i#d##dPro#######$##############|##*
#    adding B-Req 4.4.10.2## #□#i#□#
```

```
#ÿÿÿÿ#########e###I#######¡#d##dPro##### #□# #□#####
#####I#e#######"#0#K###¡#À#currentpoint##¡#À##/legm_top exch def##¡#À##/legm_left
exch def#"###4###¡#À#currentpoint##¡#À#'/legm_high exch legm_top sub 2 div def
##¡#À#(/legm_wide exch legm_left sub 2 div def#¡#À##gsave#¡#À##newpath#¡#À##0
setlinewidth##¡#À#&/save_matrix matrix currentmatrix def#¡#À#9legm_wide legm_left
add legm_high legm_top add translate##¡#À#
45 rotate#¡#À#Alegm_wide legm_left add neg legm_high legm_top add neg translate
##¡#À##/legm_high legm_high 2 mul def##¡#À##/legm_wide legm_wide 2 mul def
##¡#À##legm_left legm_top moveto#¡#À##0 legm_high rlineto#¡#À##legm_wide 0 rlineto
#¡#À##0 legm_high neg rlineto#¡#À##save_matrix setmatrix#¡#À##clip##¡#À##gsave
#¡#d##dPro#####¡#d#6dPro############□¨õ####p£ÿÿ####ê=ÿÿ##¨õÿÿÿÿ##ð##########`####
#H#d###À#Á□ÿ###¿#À#Á#Â□ÿ###¾#¿#Â#Ã□ÿ###½#¾#Ã#Ä□ÿ###¼#½#Ä#Å□ÿ###»#¼#Å#Æ□ÿ###º#»#Æ#Ç
□ÿ###¹#º#Ç#È□ÿ#   #¸#¹#È#É□ÿ#
#·#¸#É#Ê□ÿ###¶#·#Ê#Ë□ÿ#
```

```
ªh#i########¨õ#i#####i#d##dPro#####i#À# grestore##i#Ø####@##i#Ö####@## #×########
###
#####I#e#####!#¤#À#i#Ê###########i#È#####-#-##i#¶###¢########@#0#K###4# #É#i#Ö##
##@## #×# #Ù#i#Ö####@##i#Ø####@## #¾# #Ù#####p#######H#d###À#¥#d#H#À#¤#####À#i#Ø##
##@## #¿# #Ù# #×#i#¶############"###À###"#ª#####i#À#currentpoint##i#À##/legm_top
exch def##i#À##/legm_left exch def#"#Ë#Q###i#À#currentpoint##i#À#'/legm_high exch
legm_top sub 2 div def##i#À#(/legm_wide exch legm_left sub 2 div def#i#À##gsave
#i#À##newpath#i#À##0 setlinewidth##i#À#&/save_matrix matrix currentmatrix def
#i#À#'/legm_wide legm_wide 2 mul 302 div def##i#À#&/legm_high legm_high 2 mul 33
div def#i#À##legm_left legm_top translate##i#À##legm_wide legm_high scale#i#À##0 0
moveto##i#À##302 15 lineto#i#À#33 33 lineto##i#À##0 0 lineto##i#À##save_matrix
setmatrix#i#À##clip##i#À##gsave
#i#d##dPro#####i#d#6dPro############¨õ####p£ÿÿ####ê=ÿÿ##¨õÿÿÿÿ##ñ##########.#ª#$
#Ë#K#ª#$#-ÿ#«#$#%#-#Aÿ#¬#%#&#A#Uÿ#-
#&#'#U#iÿ#®#'#(#i#~ÿ#¯#(#)#~#ÿ#°#)#*##¦ÿ#±#*#+#¦#ºÿ#²#+#,#º#Îÿ#³#,#-
#Î#âÿ#´#-
#.#â#öÿ#µ#.#/#ö##ÿ#¶#/#0####ÿ#·#0#1###3ÿ#¸#1#2#3#Gÿ#¹#2#3#G#Kÿ#º#3#4#<#Kÿ#»
#4#5#-#<ÿ#¼#5#6###-
ÿ#½#6#7####ÿ#¾#7#8####ÿ#¿#8#9#ñ##ÿ#À#9#:#â#ñÿ#Á#:#;#Ó#âÿ#Â#;#<#Ä#Óÿ#Ã#<#=#µ#
Äÿ#Ä#=#>#¦#µÿ#Å#>#?##¦ÿ#Æ#?
#@##ÿ#Ç#@#A#y#ÿ#È#A#B#j#yÿ#É#B#C#[#jÿ#Ê#C#D#L#[ÿ#Ë#D#Lÿÿ#"üÂü;ÿÿ#i#À#
      grestore######¨õ####### #ª###ª#P####"M±©# #«###«#P####+#º]#
#¬###¬#P####3µÃ## #####P####<iËÅ# #®###®#P####E#Ôy# #¯###¯#P####MÒÝ.#
#°###°#P####Våâ# #±###±#P####_:î# #²###²#P####gî÷J# #³###³#P####p¢ÿþ# #´###
´#P####p£ÿÿ# #µ###µ#P####|Ìÿÿ# #¶###¶#P####õÿÿ# #·###·#P#####ÿÿ#
#¸###¸#P####iGÿÿ# #¹###¹#P####pÿÿ# #º###º#P####¹ÿÿ# #»###»#P####ÅÂÿÿ#
#¼###¼#P####Ñëÿÿ# #½###½#P####Þ#ÿÿ# #¾###¾#P####ê=ÿÿ# #¿###¿#P# #À###À#P###åìjÿÿ#
#Á###Á#P##!Êîÿÿ# #Â###Â#P##2¯ðÄÿÿ# #Ã###Ã#P##Còñÿÿ# #Ä###Ä#P##Tyõ#ÿÿ#
#Å###Å#P##e_÷Kÿÿ# #Æ###Æ#P##vDùxÿÿ# #Ç###Ç#P##)û¥ÿÿ# #È###È#P###ýÒÿÿ#
#É###É#P##¨õÿÿÿÿ# #Ê###Ê#P#i#d##dPro#####i#À#  grestore###########
#####I#e#######p###ª###Ë#Q#ª###¹#Q#Ë#D#ª###ª###i#d##dPro##### # #i#¤###P###
#########"#ª#####!#¹#Q#####!#Ë#D######ßß##### #£###
#####I#e#!#¹#Q#!#Ë#D##ßß# #i#"#Ü#U###i#À#currentpoint##i#À##/legm_top exch def
##i#À##/legm_left exch def#"#ô#####i#À#currentpoint##i#À#'/legm_high exch legm_top
sub 2 div def##i#À#(/legm_wide exch legm_left sub 2 div def#i#À##gsave
#i#À##newpath#i#À##0 setlinewidth##i#À#&/save_matrix matrix currentmatrix def
#i#À#'/legm_wide legm_wide 2 mul 197 div def##i#À#&/legm_high legm_high 2 mul 24
div def#i#À##legm_left legm_top translate##i#À##legm_wide legm_high scale#i#À##0 0
moveto##i#À##197 11 lineto#i#À#24 24 lineto##i#À##0 0 lineto##i#À##save_matrix
setmatrix#i#À##clip##i#À##gsave
#i#d##dPro#####i#d#6dPro############¨õ####p£ÿÿ####ê=ÿÿ##¨õÿÿÿÿ##ñ##########<#Ü#V
#õ###Ü#V#]ÿ#Ý#V#W#]#nÿ#Þ#W#X#n#~ÿ#ß#X#Y#~#ÿ#à#Y#Z##ÿ#á#Z#[##°ÿ#â#[#\#°#À
ÿ#ã#\#]#À#Ñÿ#ä#]#^#Ñ#áÿ#å#^#_#á#òÿ#æ#_#`#ò##ÿ#ç#`#a####ÿ#è#a#b####ÿ#é#b#c##
##ÿ#ê#c#d#û##ÿ#ë#d#e#í#ûÿ#ì#e#f#à#íÿ#í#f#g#Ó#àÿ#î#g#h#Æ#Óÿ#ï#h#i#¸#Æÿ#ð#i#j
#«#¸ÿ#ñ#j#k##«ÿ#ò#k#l##ÿ#ó#l#m##ÿ#ô#m#n#v#ÿ#õ#n#v#ÿÿ#"üôümÿÿ#i#À#
      grestore######¨õ####### #Ü#U#Ü######&#µd# #Ý#U#Ý######2wÁÓ#
#Þ#U#Þ######>æÎB# #ß#U#ß######KUÚ±# #à#U#à######WÄç # #á#U#á######d3ó#
#â#U#â######p¢ÿþ# #ã#U#ã######p£ÿÿ# #ä#U#ä#######ÿÿ# #å#U#å######aÿÿ#
#æ#U#æ######¤Àÿÿ# #ç#U#ç######¶#ÿÿ# #è#U#è######Ç~ÿÿ# #é#U#é######ØÝÿÿ#
#ê#U#ê######ê<ÿÿ# #ë#U#ë######ê=ÿÿ# #ì#U#ì######ìõÿÿ# #í#U#í####*=ïÿÿ# #î#U#î####?
[òeÿÿ# #ï#U#ï####Tzõ#ÿÿ# #ð#U#ð####i÷Öÿÿ# #ñ#U#ñ####~·úÿÿ# #ò#U#ò####ÕýFÿÿ#
#ó#U#ó####¨ôÿÿÿÿ# #ô#U#ô###i#d##dPro#####i#À#  grestore###########
#####I#e#######p###Ü#U#õ###Ü#U#è###õ#n#Ü#U#Ü#U#i#d##dPro##### # #i#¤###P###
#########"#Ü#U###!#è#######!#õ#n######çç##### #£###
#####I#e#!#è###!#õ#n##çç# #i#"#|#%###i#À#currentpoint##i#À##/legm_top exch def
##i#À##/legm_left exch def#"##I###i#À#currentpoint##i#À#'/legm_high exch legm_top
sub 2 div def##i#À#(/legm_wide exch legm_left sub 2 div def#i#À##gsave
#i#À##newpath#i#À##0 setlinewidth##i#À#&/save_matrix matrix currentmatrix def
```

```
#¡#À#'/legm_wide legm_wide 2 mul 292 div def##¡#À#&/legm_high legm_high 2 mul 33
div def#¡#À##legm_left legm_top translate##¡#À##legm_wide legm_high scale#¡#À#
```